



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Izbrana poglavja iz speleobiologije</b>
<b>Course title:</b>	<b>Selected Topics in Speleobiology</b>

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Doktorski študij Ekološke znanosti, 3. stopnja		1. ali 2.; 1st or 2nd	1.- 4.; 1st-4th
Doctoral Study Ecological Sciences, 3rd degree			

Vrsta predmeta / Course type: Izbirni/Elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
3	3		5	9	160	6

Nosilec predmeta / Lecturer: Tone NOVAK

Jeziki / Predavanja / Lectures: slovenski / Slovene  
Languages: Vaje / Tutorial: slovenski / Slovene

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Poznavanje organizmov in ekologije na ravni univerzitetnega programa

**Prerequisites:**

Knowledge of organisms and ecology at graduate level

**Vsebina:**

Obravnavana so izbrana poglavja iz naslednjih sklopov.  
Podzemeljski habitati so naravne in umetne votline. S slovenskega ozemlja sta opisana prvi podzemeljski vretenčar, človeška ribica, ter prvi nevretenčar, hrošč drobnovratnik. Oris zgodovine speleobiologije, ki so jo zasnovali raziskovalci na slovenskem ozemlju. Pregled značilnih fizičnih razmer v podzemeljskih habitatih ter pregled splošnih značilnosti podzemeljskih živih bitij. Ekološke razmere v

**Content (Syllabus outline):**

Selected topics in the following chapters are discussed.  
Hypogean habitats are natural and artificial cavities. In the territory of Slovenia, the first vertebrate: the olm, and the first invertebrate: the bittle slender-neck, have been described. A concise historical review of the speleobiology, which had started in the territory of Slovenia. The overview of general physical characteristics of the hypogean habitats, and the review of general characteristics of the

posameznih podzemeljskih tipih habitatov (naravne in umetne votline, epikras). Troglokseni, troglofilii, troglobionti; freatokseni, freatofili, freatobionti. Specifične ekološke, morfološke, fiziološke in citološke prilagoditve na podzemeljske habitate. Na terenu in v laboratoriju so prikazani vzori za ekološke raziskave podzemeljskih habitatov.

hypogean organisms. Ecological circumstances in hypogean habitat types (natural and artificial cavities, epikarst). Trogloxenes, troglophile, troglobionts; phreatoxenes, phreatofiles, phreatobiont. Specific ecological, morphological, physiological and cytological adaptation to hypogean habitats. In field and in the laboratory, some examples of ecological investigations in hypogean habitats are presented.

### Temeljni literatura in viri / Readings:

- Culver D. C., Christman M. C., Sket B., Trontelj P., 2004. Sampling adequacy in an extreme environment: species richness patterns in Slovenian caves. *Biodiversity and Conservation*, 13: 1209- 1229.
- Culver D. C., Pipan T., 2009. *The biology of caves and other subterranean habitats*. Oxford Univ. Press, Oxford, New York.
- Culver, D. C., W. B. White (eds.), 2012: *Encyclopedia of caves*. Elsevier/Academic Press, Amsterdam/Boston.
- Gunn, J., 2004: *Encyclopedia of caves and karst science*. Taylor & Francis Books Inc., New York/London.
- Juberthie, C. & V. Decu (eds.), 1992-1996: *Encyclopaedia biospeologica I-III*. Societé de biospéologie, Moulis, Bukarest.
- Kozel, P., Pipan, T., Šajna, N., Polak, S., Novak, T. (2017) Mitigating the conflict between pitfall-trap sampling and conservation of terrestrial subterranean communities in caves. *International journal of speleology*, 46(3),359–368. doi: [10.5038/1827-806X.46.3.2123](https://doi.org/10.5038/1827-806X.46.3.2123).
- Kozel, P., Pipan, T., Mammola, S., Culver, D. C., Novak, T. (v tisku) Distributional dynamics of a specialized subterranean community oppose the classical understanding of the preferred subterranean habitats. *Invertebrate biology*.
- Moldovan, O. T., Kováč, L., Halse, S. (Eds.) (2018). *Cave ecology*. Springer International Publishing. 545 str.
- Pipan, T., Culver, D. C., Papi, F., Kozel, P. (2018) Partitioning diversity in subterranean invertebrates : the epikarst fauna of Slovenia. *PloS ONE* 13(5), 1-19. doi: [10.1371/journal.pone.0195991](https://doi.org/10.1371/journal.pone.0195991).
- Sket B., Paragamian K., Trontelj P., 2004. A census of the obligate subterranean fauna of the Balkan peninsula. In: Griffiths H. I., B. Kryštufek (eds.): *Balkan Biodiversity. Pattern and Process in Europe's Biodiversity Hotspot*. Kluwer Academic Publishers: 309-322.

**Cilji in kompetence:**

**Objectives and competences:**

- Podati podroben pregled tipov in značilnosti podzemeljskih habitatov
- Podati podroben pregled tipov in značilnosti podzemeljskih organizmov
- Podrobno predstaviti zgodovino speleobiologije in modernih trendov v njej
- Podrobno pojasniti osnovne ekološke razmere v podzemeljskih habitatih
- Podrobno prikazati izbrane metode ekološkega vzorcevanja v jamah

- To give an advanced overview of typology and characteristics of hypogean habitats
- To give an advanced overview of typology and characteristics of hypogean organisms
- To present advanced knowledge about the history and modern trends in speleobiology
- To explain in detail ecological circumstances in hypogean habitats
- To present in detail selected ecological sampling methods in caves

**Predvideni študijski rezultati:**

**Znanje in razumevanje:**

- Poglobljeno razumevanje ekoloških značilnosti podzemeljskih habitatov
- Poglobljeno razumevanje biotskih značilnosti podzemeljskih organizmov
- Podrobna zgodovina speleobiologije in trendi modernih znanstvenih raziskav
- Poglobljeno poznavanje vzorčevalnih metod v podzemeljskih habitatih

**Prenesljive/ključne spretnosti in drugi atributi:**

- Podrobno repoznavanje troglomorfnih znakov
- Usposobljenost za zahtevno ekološko raziskovalno delo v podzemeljskih votlinah

**Metode poučevanja in učenja:**

- Predavanja
- Laboratorijske vaje
- Terenske vaje
- Individulano načrtovanje izbrane raziskave

**Intended learning outcomes:**

**Knowledge and understanding:**

- Advanced understanding of ecological characteristics of hypogean habitats
- Advanced understanding of biotic characteristics of hypogean organisms
- Advanced history of speleobiology and modern trends of scientific investigations
- Advanced knowledge about the elementary sampling methods in hypogean habitats

**Transferable/Key Skills and other attributes:**

- Advanced recognition of troglomorphoses
- Capability of top-level ecological investigations in cavities

**Learning and teaching methods:**

- Lectures
- Laboratory excersises
- Field excersises
- Individual planning of a selected investigation

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

<ul style="list-style-type: none"> <li>• Individualni raziskovalni projekt – pisni in ustna predstavitev</li> <li>• Pisni izpit</li> </ul>	50 % 50%	<ul style="list-style-type: none"> <li>• Individual project work – written, and oral presentation</li> <li>• Written exam</li> </ul>
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**Reference nosilca / Lecturer's references:**

Kozel P., Pipan T., Šajna N., Polak S, Novak T., 2017. Mitigating the conflict between pitfall-trap sampling and conservation of terrestrial subterranean communities in caves. *International Journal of Speleology* 46(3). In print.

Lipovšek, S., Janžekovič, F., Novak, T., 2017. Ultrastructure of fat body cells and Malpighian tubule cells in overwintering *Scoliopteryx libatrix* (Noctuoidea). *Protoplasma*, DOI 10.1007/s00709-017-1110-3

Lipovšek, S., Novak, 2016. Autophagy in the fat body cells of the cave cricket *Troglophilus neglectus* Krauss, 1878 (Rhaphidophoridae, Saltatoria) during overwintering. *Protoplasma*. pp. 10. DOI 10.1007/s00709-015-0824-3

Novak, T., Kozel, P., 2014. *Hadzinia ferrani*, sp. n. (Opiliones: Nemastomatidae), a highly specialized troglolithic harvestman from Slovenia. *Zootaxa* 3841(1), 135–145. <http://biotaxa.org/Zootaxa/login?source=%2FZootaxa%2Farticle%2Fview%2Fzootaxa.3841.1.8%2F9353&loginMessage=reader.subscriptionRequiredLoginText>

Novak, T., Šajna, N., Antolinc, E., Lipovšek, S., Devetak, D., Janžekovič, F., 2014. Cold tolerance in terrestrial invertebrates inhabiting subterranean habitats. *International Journal of Speleology* 43(3), 265–272. <http://scholarcommons.usf.edu/ijs/vol43/iss3/3>